Title: Patternville

Brief Overview:

This is an interactive unit where students will design a community using pattern blocks. Their community will include streets and houses. Students will also consider the elements of a map and the wants and needs of a community along with the construction of their community. Students will use all four of their communication skills in the process of creating their community.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with social studies and real life situations.

- **Estimation**
  Students will demonstrate their ability to estimate in a problem solving situation.

- **Number Sense and Numeration**
  Students will demonstrate their ability to solve problems using arithmetic operations, with t technology where appropriate. They will determine reasonableness of solutions. Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and orally describe effects of operations on numbers.

- **Geometry and Spatial Sense**
  Students will demonstrate their ability to apply geometric relationships using three dimensional objects.

- **Measurement**
  Students will demonstrate their ability to estimate and verify their measurements.

- **Statistics and Probability**
  Students will demonstrate their ability to collect, organize, and display data and will interpret information obtained from displays. They will write reports based on statistical information.

- **Patterns and Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data. Students will demonstrate their ability to perform algebraic operations and will be able to model algebraic concepts using concrete materials.

Grade/Level:

Grade 3

Duration:

5 one hour class periods

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Estimating
- Identifying basic patterns
- Distinguishing odds and evens
- Distinguishing geometric shapes
- Distinguishing coins and their value
- Using calculators
- Using basic probability
- Using ordinal numbers

Objectives:

Students will:

- work cooperatively in groups.
- identify and construct complex patterns.
- apply number relationships.
- communicate mathematical terms.
- use problem solving strategies to solve multi-step problems.
- make predictions.
- collect, organize, and record data on a table using tally marks or numbers.
- use repeated addition or multiplication to solve a problem.
- add and subtract money.
- make change from $5.00.

Materials/Resources/Printed Materials:

- Pattern blocks
- Overhead projector
- Transparencies
- Overhead pens
- "Math talk" chart
- Student resource sheets
- Tag board or large construction paper for each group of students
- Crayons
- Calculators
- Sentence strips (optional)
- Glue (optional)

- The Little House by Virginia Lee Burton, copyright 1942 Houghton Mifflin Company

Development/Procedures:

Day 1--Task 1

Read The Little House by Virginia Lee Burton to students. If time allows, read first for enjoyment and a second time so students can look for patterns to discuss and to add appropriate math vocabulary to the "math talk" chart.

Students should be in cooperative groups of 4. Distribute the pages for Task 1. Depending on the reading level of students, they read problems 1-4 silently or in cooperative groups. Students can answer questions in their small group, but each student is responsible for writing on their own papers.

Responses to questions can be shared by having students write their answers on the teacher's overhead.

Devote enough time to #4 so that each group can share its answer. This should be done in order to develop an exemplary response that meets the set criteria that should be posted so that students can refer to it as they complete the task. This response may be generated as a whole class.

Collect the pages for Task 1 as they will be used on Day 3.

Day 2

Provide students with opportunities to:

1. identify the core and terms of patterns.
2. remove the patterns (e.g., ABCAABCA)
3. extend patterns to a given term.

Explain to the students that they will be building their own class community over the next several days.

Pairs of students will create their own patterns of houses as in #1 of Task 1. You might want to have them create their pattern on a piece of paper or in their math journals if you are going to assess this objective. They could then copy the pattern on a sentence strip which would be used on the map they are building. If you want to have the houses stand up on the map, fold the bottom of the sentence strip back to form a stand. The stand can be glued or taped to the map.

Students should be aware that the terms in the pattern should be made of the same shapes as in Task 1 and that the core should be repeated at least twice.

When students complete their original pattern, have them take out their math journals and describe their pattern following the Rubric for Task 1 that should be posted.

Day 3--Task 2

Students are working in pairs.

Have hexagonal and triangular pattern blocks available for pairs of students.

Students will need Task 1. Distribute the pages for Task 2 to the students.

Give students 2 minutes to **think** about missing details from the houses. Then they **share** ideas with their partner for 1 minute. Give them 3 minutes to **write** responses to #1. Give students 2 minutes to share their written responses within their small group of 4.

Give students 2 minutes to read and discuss how houses are numbered on their streets. Have students share their responses in the form of a class discussion. If they don't know, lead them to the desired response.

Give them 5 minutes to complete 2a. and 2b. independently, encouraging them to check their work.

Review responses to 2a. and b.

Teacher should review basic probability vocabulary and make sure it's on the "math talk" chart.

Read #3 and #4 to the class. Give students 10 minutes to complete both problems independently. Review answers as well as problem solving strategies used.

Read #5 to the class, referring them to the illustration below it. Teacher copies the pattern with overhead pattern blocks. Have a student continue 1 more repetition by adding to the first section on the overhead while the others are using the pattern blocks at their seats. Challenge them to use their problem solving strategies to find the answer to 5a. After giving appropriate wait time, have students share strategies and answers. Ponder new strategies and introduce the function table (T chart) as a means of organizing data and finding patterns and relationships between numbers. After completing 5a., give students a choice of completing 5b. and c. independently or by working more closely with the teacher.

Give those who worked independently a chance to share their responses.

Day 4

For Warm Ups, give students more practice with function tables using resources such as:

1. The Pattern Factory: Elementary Problem Solving Through Patterning
   by Ann Roper and Linda Harvey, Creative Publications

2. Algebraic Thinking: First Experiences
   by Linda Holden Charles, Creative Publications

Explain to the students that they will be constructing some streets for their community using the pattern investigated in Task 2.

Groups of 4 students will use pattern blocks to create streets for their community. They could copy the pattern on a sentence strip which may be glued on the map they are building or they could draw directly on it. Be sure that the streets correspond with the houses in a sensible way so that houses do not interfere with traffic patterns.

Day 5--Task 3

Teacher will write the words "goods" and "services" on chart paper or the chalkboard. Give the students 2 minutes to **think** of what they know about the words. Have them **pair** with their neighbor to tell what they know about goods and services. As students then **share** their ideas, teacher records ideas. Give students 5 minutes to complete #1 of Task 3 independently.

Choose a volunteer to read #2 aloud. Encourage students to think about previous tasks they have completed using function tables and add the three new Help Wanted signs. Have them complete #2 independently. Use your own judgment to set the amount of time available to students. A rubric is supplied for assessment purposes.

Pass out calculators. Have students read **all** sections of #3 independently **before** beginning. Stress the importance of answering **all** parts of the question and **checking** their work in this section. Give students a predetermined amount of time to complete all of #3.

Performance Assessment:

Students can be assessed on the following criteria:

Use a checklist or spec sheet to see that children are developing each skill and are utilizing their problem solving strategies.

Use anecdotal record or spec sheet to see that necessary elements are in responses.

Observation

Creating a function table (rubric for a function table is Teacher Resource #1)

Construction of a pattern and using the appropriate math vocabulary to describe it (rubric for pattern is Teacher Resource #2)

Extension/Follow Up:

Create own patterns on sentence strips to be put at a center. Be sure the core is written on the back for self-checking.

Begin a book of original patterns or patterns they see in their daily life that can be added to throughout the year.

Create pattern jewelry for someone.

Identify rhythmic patterns in songs and poetry.

Identify patterns or repeated parts in stories.

Create tessellations on paper or use computer program.

In Task 3, students could add the goods and services that all communities have in common to their map. Also add natural / cultural features to their map and create a key for the finished product.

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References:

Teaching Children Mathematics, Vol. 3, No. 6, Feb. '97
The Pattern Factory: Elementary Problem Solving Through Patterning by Ann Roper and Linda Harvey, Creative Publications
The Problem Solver 2, Creative Publications, T-47
The Little House by Virginia Lee Burton

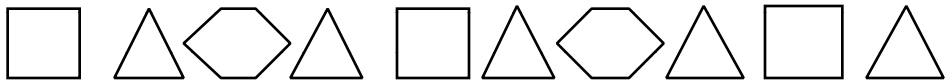
Name: _____

Patternville

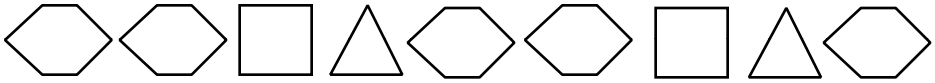
Task 1

Prompt: In your community, the planners have decided to make some of the houses with triangular windows, some with square windows, and some with hexagonal windows. Below is an illustration of Eastwich Street and Westwich Street. The planners decided to use the shape of the window to represent each house.

Eastwich Street



Westwich Street



1. Three new houses must be added to each street. Draw what you think each row of houses will look like when three new houses are added.

2. If your family wanted to purchase a house with hexagonal windows on Eastwich Street, which houses could they choose from? Use an ordinal number to tell your answer.

_____

_____

3. You will need to explain to the planners how you completed the pattern for one of the streets. In your explanation, be sure to include the name of the street, “math talk”, and clear ideas.

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

Patternville

Task 2

1. Yesterday we worked on completing patterns by adding new houses to Eastwich Street and Westwich Street. List some details you notice are missing from the houses.

_____ _____

_____ _____

2. One missing detail is a house number. Discuss what you know about how houses are numbered on your street.

a. The houses on Eastwich Street are even-numbered starting with **566**. Finish the pattern by writing the house numbers on the houses.

b. The houses on Westwich Street are odd-numbered starting with **3335**. Finish the pattern by writing the house numbers on the houses.

3. If there was a raffle to win one of the houses on Eastwich Street, what would be the probability of winning a house with triangular windows? Justify your thinking.

_____

_____

_____

_____

_____

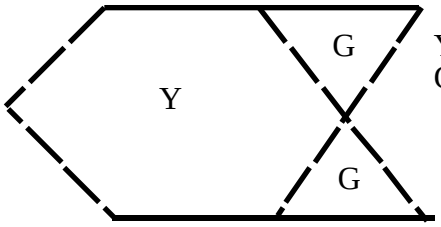
4. The mayor of Patternville, Oz, can't decide which house on Westwich Street he would like his family to live in. His wife, Harriet, decides to write each house number on a separate piece of paper and pull one out of a hat. What window shape will the house she selects most likely have? Explain your reasoning.

_____

_____

_____

5. Now that the houses have been built, it's time to pave the streets. Mayor Oz has decided the streets should be made of yellow and green bricks. It takes one yellow hexagonal brick and two green triangular bricks to make one section of the street.



Y -- Yellow Hexagon
G -- Green Triangle

a. You and your partner are in charge of ordering the bricks for the streets of Patternville. Decide how many green bricks you will need if you order six yellow bricks.

b. Westwich Street needs to be ten yellow bricks long. How many green bricks will you need to order?

_____

c. If all the streets of Patternville are 24 bricks long, estimate how many bricks you will need to order for the six streets in Patternville. Show your work and explain your answer on the lines below.

_____

_____

_____

_____

Name: _____

Patternville

Task 3

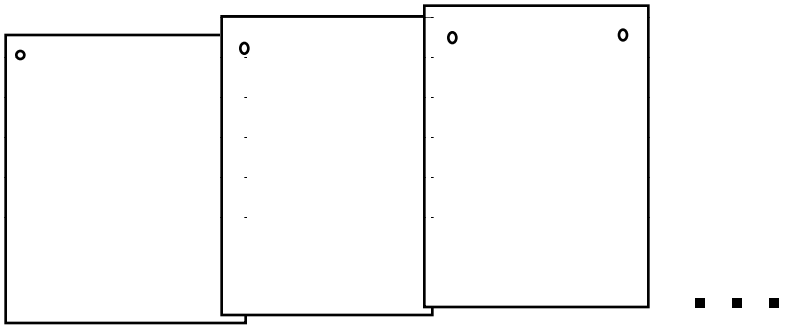
1. After several months, the construction of Patternville is complete and people have moved into the houses. Now the town needs people to provide goods and services. Name five goods or services Patternville will need.

_____ _____

_____ _____

_____

2. Your town still needs a teacher, a cashier, and a deputy. You decide to post Help Wanted signs for those services. You hang the signs side-by-side in a line. Signs that are hung next to each other share a tack.



Three more jobs become available and signs are posted for these jobs to continue the pattern that the first three signs make. How many tacks will you need now? Show your work!

Answer: _____

3. You've decided to have Staples® print your Help Wanted signs. They charge $0.25 for each sign. You will also need to buy tacks to hold the signs to the board. Staples® has tacks for $0.07 each.

a. What will your total cost be for the signs and tacks? Show your work **or** explain how you used the calculator to find the total.

_____

b. At the register you give the cashier a five dollar bill. How much change will you receive? Show your work **or** explain how you used the calculator to find the total.

_____

c. Use tally marks to complete the table to show three different ways you could receive your change.

$1.00	50c	25c	10c	5c	1c

Rubric for Task 1, (Problem #3)

3 Points

Identify core of the pattern
Use “math talk” such as: core, term, repeat, pattern, triangle, hexagon, square, etc.
Clear and sequential details

2 Points

Identify core of the pattern
Minimal use of “math talk”
Clear details
Lacks organization

1 Point

Identified the core
No use of “math talk”
Needs organization and clarity

0 Points

Core not identified
No use of “math talk”
No organization
Unclear ideas

Rubric for Task 3, (Problem #2)

3 Points

Uses correct labels
Uses correct number pattern
Identifies the correct end of the pattern
Shows all work

2 Points

No labels
Uses correct number pattern
Identifies the correct end of the pattern
Shows some work

1 Point

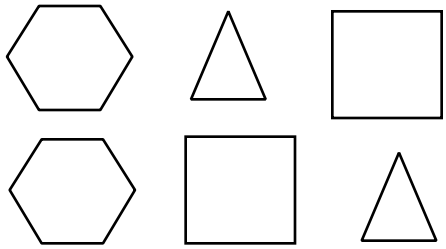
No labels
Uses correct number pattern
Identifies the correct end of the pattern
Shows no work

0 Points

No labels
Does not use correct number pattern.
Does not identify the correct end of the pattern
Shows no work

Answer Key

Task 1:

1. 

2. Third, seventh, eleventh

3. See rubric

Task 2:

1. Answers may include house numbers, windows, doors, chimneys, mailboxes, etc.

2. a. 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590

   b. 3335, 3337, 3339, 3341, 3343, 3345, 3347, 3349, 3351, 3353, 3355, 3357, 3359

3. More likely or 6/13

   Answers may vary, but should include that there are more triangles than the other shapes.

4. Hexagon

   Answers may vary , but should include that there are more hexagons than triangles and squares.

5. a.

green bricks	yellow bricks
2	1
4	2
6	3
8	4
10	5
12	6

b. 20 bricks

c. Answer should be approximately 120. Students should include an appropriate strategy for estimation in their explanation. (i.e., rounding, skip counting, front-end estimation)

Task 3:

1. Answers will vary. They may include food, clothing, shelter, transportation, protection, government, health and safety, communication, religion, and recreation.

2.

paper	tacks
1	2
2	3
3	4
4	5
5	6
6	7

Answer: 7 tacks

3. a. $1.99

b. $ 5.00
- 1.99
$ 3.01

c. Answers may vary

$1.00	50c	25c	10c	5c	1c
III		I	I		I
III			III	I	I
II	II	I	I		I